Extrapleural Nuss procedure for chest wall deformity complicating thoracotomy and pulmonary resection

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Since the introduction of the thoracoscopic Nuss operation for correction of pectus excavatum (PE) in 1998, an increasing number of patients are presenting for operations because of concerns about the appearance of the chest wall and a sensation of shortness of breath with physical activity.[1] The new minimally invasive procedure avoids the long anterior chest incision and requires neither sternal osteotomy nor excision of rib cartilage. However, its role in redo repairs or in patients with severe intrathoracic adhesions is uncertain.[2] Therefore we presented a further modification of the Nuss operation for PE after thoracotomy.

CLINICAL SUMMARY

A 19-year-old woman had a history of right middle and right lower lobe resection for multiple infected bronchogenic cysts with *Haemophilus influenzae* infection 5 years before. After lobectomy, exertional dyspnea and progressive asymmetric chest wall deformity, hypoplasia of the right chest wall, were noted. Pulmonary function test results revealed a severe restrictive ventilatory defect and revealed that forced expiratory volume in 1 second was 1.40 L (43.9%) and forced vital capacity was 1.45 L (42%). The pectus index was 8.125 (Figure 1). Because of cosmetic reasons and psychosocial impairment, she was admitted for correction of funnel chest. Based on the chest images, severe intrathoracic adhesion was predicted based on her calcified thick pleura. In the supine position and after achievement of single-lumen anesthesia, a left-sided intrathoracic thoracoscopy was performed through the left lateral chest incision (2 cm), and then the ring forceps instrument was used for the right extrapleural adhesiolysis. A 1-cm small chest incision at the right hinge point was also done to assist with the extrapleural adhesiolysis. After the substernal tunnel was created, one convex stainless-steel bar (Walter Lorenz Co, Jacksonville, Fla) was started under videoscopic guidance through bilateral chest wall midaxillary transverse incisions and subcutaneous tunneling. The bar was fixed to adjacent ribs by placing 4–0 stainless-steel wires into the

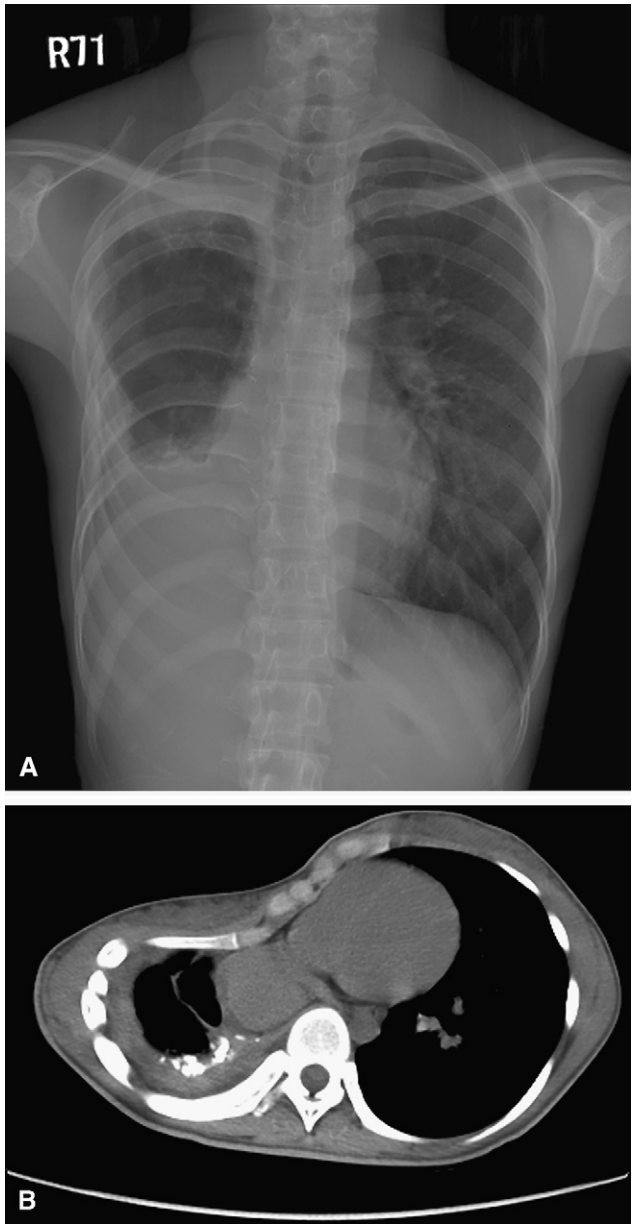

FIGURE 1. A, Chest x-ray film shows limited right lung volume and pleural thickening before the Nuss operation. B, Computed tomographic scan of the chest shows calcified pleural plaques at the right basal thoracic cavity and severe asymmetric depressed pectus excavatum.

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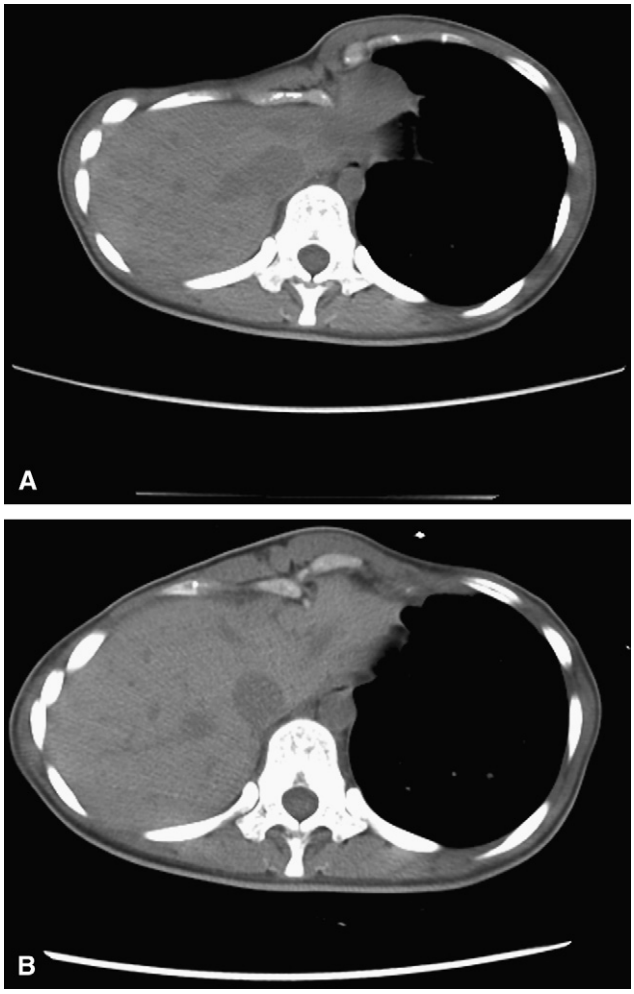

FIGURE 2. A, Preoperative lower chest computed tomographic scan. B, postoperative chest computed tomographic shows improvement of the deformity.

submuscular pockets. A closed suction drain was inserted into the left pleural cavity. The operative time was 62 minutes. Blood loss was 50 mL. Postoperative hospitalization was 4 days. There were no operative complications, and the deformity got better (Figure 2), although the postoperative pulmonary function did not improve: forced expiratory volume in 1 second was 1.40 L (43.9%), and forced vital capacity was 1.42 L (41%).

DISCUSSION

The postoperative chest wall changes after lobectomy or pneumonectomy include decreased intercostal spaces caused by volume loss, along with associated rib defects. This results in a potential deformity of the rib cage and produces a dramatic appearance on computed tomographic scanning, particularly after pneumonectomy. Parot and colleagues[3] reported on a series of 16 patients, of whom 10 survived congenital diaphragmatic hernia repair, with an incidence of isolated chest wall deformity in 4 patients during follow-up (mean, 2 years). Furthermore, calcific pleuritis with fibrothorax might restrain the lung and impair the mechanics of breathing.

Many institutions are evaluating the Nuss procedure to identify appropriate patient selection and application. Surgical challenge has been associated with diffuse pleural adhesion between the chest wall and pulmonary parenchyma in redo correction of PE, and thus surgical strategies under these circumstances are required. Recently, simultaneous pectus repair combined with other underlying diseases or redo pectus repair were studied.[2,4] However, no articles especially focus on the minimally invasive technique for pectus repair combined with severe adhesion between the chest wall and lung. With the thoracoscopic extrapleural adhesiolysis modification of the originally described Nuss procedure,[5] this minimally invasive approach gains feasibility in patients who have undergone thoracotomy. We suggest that this extrapleural approach diminishes the chance of serious injury to the pulmonary parenchyma or hilar vessels as the bar is passed under the sternum and through the mediastinum. This technique has some advantages over the reoperative open procedure,[2] including avoiding extensive dissection, short operating times, minimal blood loss, and good cosmetic results. For patients with the difficult problem of PE after thoracotomy, the minimally invasive bar repair is also a viable alternative to a traditional open repair. We conclude that this extrapleural approach for correction of PE can be performed safely despite previous thoracic surgery.

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